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THE VELIGER

NOTES, INFORMATION & NEWS

Change of Editorship for *The Veliger*

A scholarly journal like *The Veliger* represents a partnership among authors, editors, reviewers, printers, and readers. Since volume 37, the preparation of which began in 1993, I have been privileged to serve this partnership in the capacity of Editor-In-Chief. I have been joined in this effort by Leslie Roth, Production Editor. When I write here in the first person plural, it reflects not merely the traditional "editorial We," but the fact that for 11 years the *Veliger* editorship has truly been our joint project. Together we have tried to uphold the scientific and literary standards set by R. Stohler, the journal's founder, and D. W. Phillips, the previous Editor-In-Chief.

The time is now appropriate for a change of editorship, and the California Malacozoological Society, Inc. ("CMS") has undertaken the search for a new editor. As of this writing, the new person or persons have not been selected. Their identity, and the address to which all new manuscripts and editorial correspondence should be directed, will be made known at the earliest possible date, at the web site www.theveliger.org and in other applicable venues. E-mail sent to editor@theveliger.org will be directed to the new editor(s).

We thank the Board of Directors of CMS for their unfailing support; the authors who showed their trust in us by submitting manuscripts for our consideration; the numerous specialists who donated their time and effort to provide essential peer review; and the staff of Allen Press, Inc., for their professionalism in seeing our contributors' words into print. To the readership of *The Veliger,* we hope we have lived up to your expectations and know that you will continue to be well served in the future.

Barry Roth

Use of Birefringence to Characterize Aplacophora Sclerites

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The calcium carbonate sclerites of Aplacophora provide major taxonomic characters at both species and higher taxa levels. They are formed of aragonite crystals by a single cell (Rieger & Sterrer, 1975; Haas, 1981; Scheltema, 1985). In all species of Chaetodermomorpha (chaetoderms or Caudofoveata) they are solid structures, and are either solid or hollow in species of Neomeniomorpha (neomenioids or Solenogastres). Sculpturing may be present. Size varies from a few to hundreds of microns in length and 1 to >10 μm in thickness. Shapes vary widely. In chaetoderms, sclerites are elongate and leaflike, spatulate, or rod-shaped; in neomenioids, they are leaflike and ovate, or elongate needles, or fishhook-like, trowel-shaped, or curved in various ways.

The morphology of aplacophoran sclerites from different regions of the body are described by line drawings indicating size and shape (Figure 1E), by scanning electron micrography for imaging fine details and as an aid in interpreting line drawings (Figures 1A, 2), and, for solid sclerites, by birefingent patterns produced under a light microscope equipped with polarizing lenses (Figures 1C, D, 3). Line drawings and SEM images are standard practices in invertebrate taxonomy, but the use of birefringence is not so usual. The method is described here for Aplacophora, and the resulting images are compared to SEMs using species of Prochaetodermatidae genera for examples.

Permanent or temporary slides are made by removing sclerites with a needle from discrete regions of the body either into a drop of water on a flat slide before air drying and mounting with a histologic mountant, or into glycerine on a depression slide. Sclerites in glycerine can be manipulated in order to determine rotations of the blade (Figure 1E, a) and base (Figure 1E, b) around the long axis and for quick identifications. When placed between crossed or parallel polarizers of a light microscope, sclerites produce bands of rainbow colors owing to the large double refraction of aragonite crystals. The bands, or isochromes, are species specific in their topography, depending upon where and to what extent each sclerite is thickened (Figure 3). Color photographs presented here were made with a Kodak MDS 290 digital camera mounted on a Zeiss Axioscope with differential interference contrast (DIC) for cross-polarized light. It is possible to obtain a Polarizer/Analyzer Filter Set from a number of companies for microscopes not equipped with polarizers. The analyzer mounts under the head and above the objective; the polarizer sits on top of the light source and can be rotated. For publication, isochromes can be indicated by dotted contours on line drawings (Figure 3E).

The interference colors exhibited by a sclerite are compared to a standard crystallographer's chart relating bi-

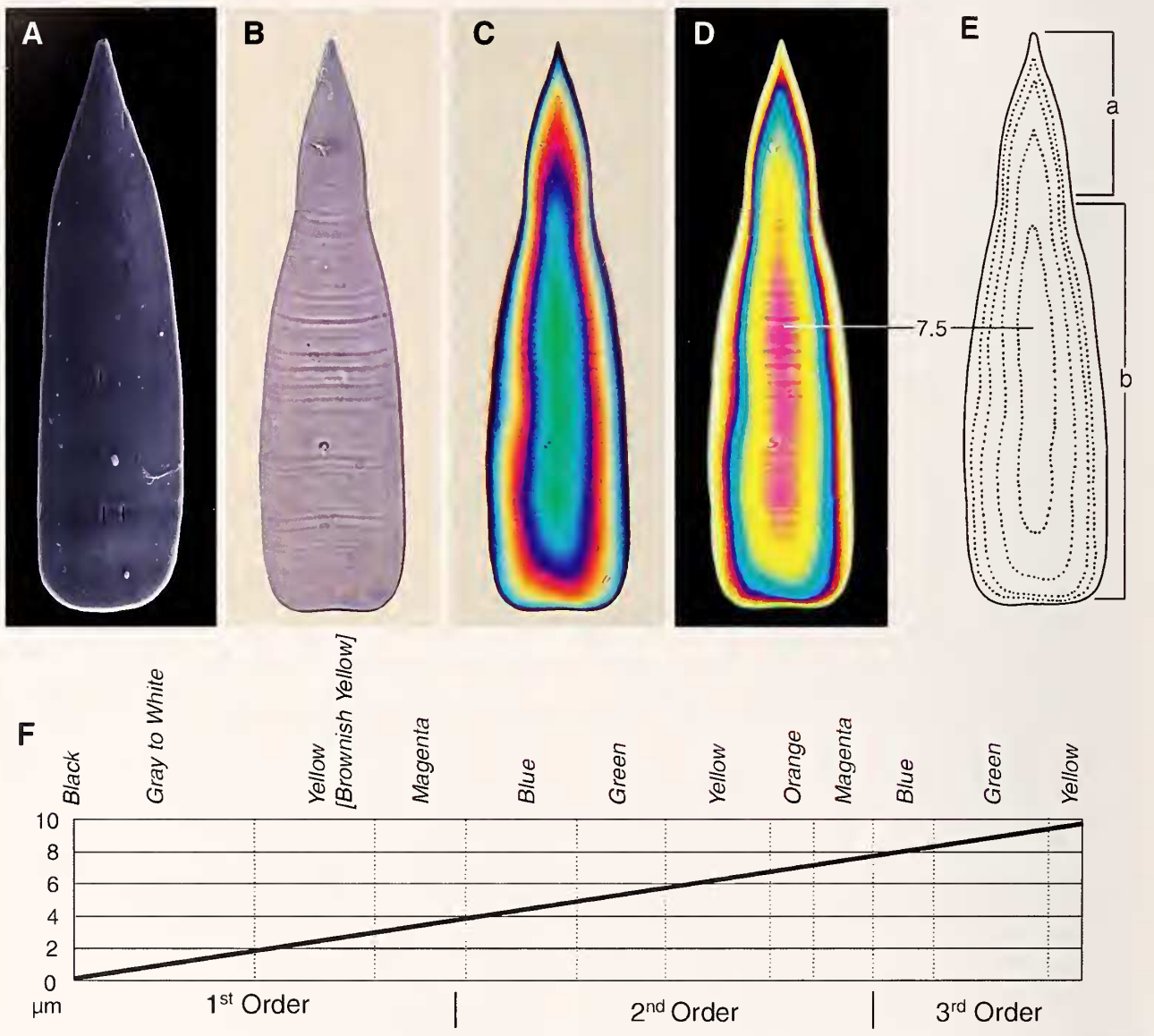

Figure 1. A–E. Sclerites from the anterior trunk region of *Claviderma brevicaudatum* Scheltema & Ivanov, 2000. A. SEM showing medially raised surface. B–D. An individual sclerite photographed under (B) plain transmitted light, with growth lines clearly seen, (C) parallel polarized light with clear background, and (D) cross-polarized light with sclerite under extinction. E. Same sclerite as B–D drawn using a camera lucida, isochromes (color bands) indicated by dotted lines; a, blade, b, base of sclerite. F. Refractive index of aragonite (0.155) represented on a crystallographer's standard birefringence chart by a thick diagonal line that cuts across horizontal lines indicating crystal thickness in µm at left. Vertical dotted lines are approximate boundaries between color bands produced by the sclerite under cross-polarized light. The color bands in D, from the edge of the sclerite to the center, are gray to yellow, 1–3 µm; magenta, 3.5 µm; blue, 4 µm; green (very narrow), 5 µm; yellow, 6 µm; orange not evident; magenta, 7.5 µm, the greatest thickness. The color bands under parallel polarized light (C) indicate thickness about 2 µm too great, with greatest thickness green, falsely interpreting thickness to be 9 µm.

refringence, interference colors, and thickness, upon which is drawn a diagonal representing the aragonite refractive index (e.g., Wahlstrom, 1951:104 [black & white]; Rogers & Kerr, 1942:162–163 [color]) (Figure 1F). The greatest sclerite thickness can be determined from the highest interference color exhibited under crossed polarizers when light is extinguished in the background (Figure 1D). The colors indicate the following approximate thickness, starting at the edge of the sclerite, which displays a narrow black line: *1st order:* gray to

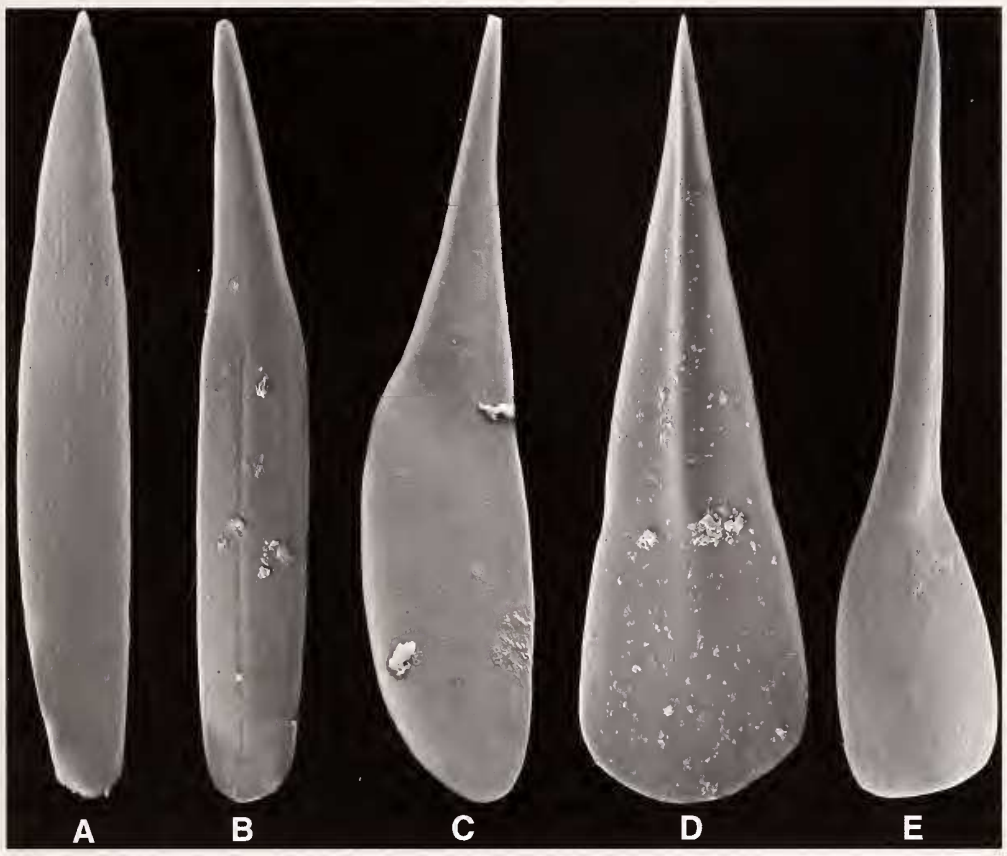

Figure 2. SEM images, frontal view, of sclerites from species representing five genera of Prochaetodermatidae. Images reproduced at same length for purposes of comparison; blade and base widths and lengths vary among species within a genus. A. *Claviderma gagei* Ivanov & Scheltema, 2001, with fine longitudinal striations, planes of base and blade curved longitudinally toward body, and longitudinal axis curved in this view from left to right. B. *Chevroderma turnerae* Scheltema, 1985, with medial longitudinal groove, longitudinal striations, and chevron-shaped growth lines; waist distinct, plane of blade lifted outward relative to base. C. *Spathoderma clenchi* Scheltema, 1985, plane of blade bent outward at waist, basal end asymmetrical. D. *Prochaetoderma yongei* Scheltema, 1985, base and blade in one plane, keel from distal point to slightly below waist, longitudinal axis straight. E. *Niteomica hystrix* Scheltema & Ivanov, 2000, base curved transversely, thick, keeled blade sharply bent outward from plane of base, both base and blade with ridges and striations.

creamy white, 1–2 μm; yellow to yellowish brown, 2–3 μm; magenta, 3.5 μm; *2nd order:* blue, 4 μm; pale green, 5 μm; yellow, 6 μm; orange, 7 μm; magenta, 7.5 μm; *3rd order:* blue, 8 μm; green, 9 μm; yellow, 10 μm. In sclerites thicker than 10 μm, alternating bands of pink and green appear.

Parallel polarizers produce interference colors against a light background (Figure 1C) and are 1 to 2 μm higher than those produced under crossed polarizers. (The thickness of sclerites given in earlier publications of Scheltema [1985, 1989] and Scheltema et al. [1991], which were read under parallel polarizers, should be corrected by this factor.) Thickness read by interpreting a color chart is somewhat subjective, particularly as the color bands blend into each other both on the chart and in the sclerite, but is usually accurate to within 1–1.5 μm.

It is the pattern made by the isochromes in sclerites of different species that is equally or more important for taxonomic purposes than the absolute thickness of sclerites (Figure 3). For instance, these patterns have made the synonymy of *Chaetoderma montereyensis* Heath, and *C. attenuata* Heath, with *C. argenteum* Heath, more certain (Scheltema et al., 1991), and they have likewise been useful in differentiating two very similar, sympatric species of *Chevroderma* (Scheltema, 1985; *C. turnerae* and *C. gauson*).

A complete description of aplacophorans with solid sclerites should include the morphology of sclerites from several regions of the body, both dorsal and ventral, based on plain transmitted light, cross-polarized light, and scanning electron micrograph images. As color photographs are expensive to print, line drawings need to include some device to indicate the pattern of birefringent color bands. In future, color plates can be made accessible on the web.

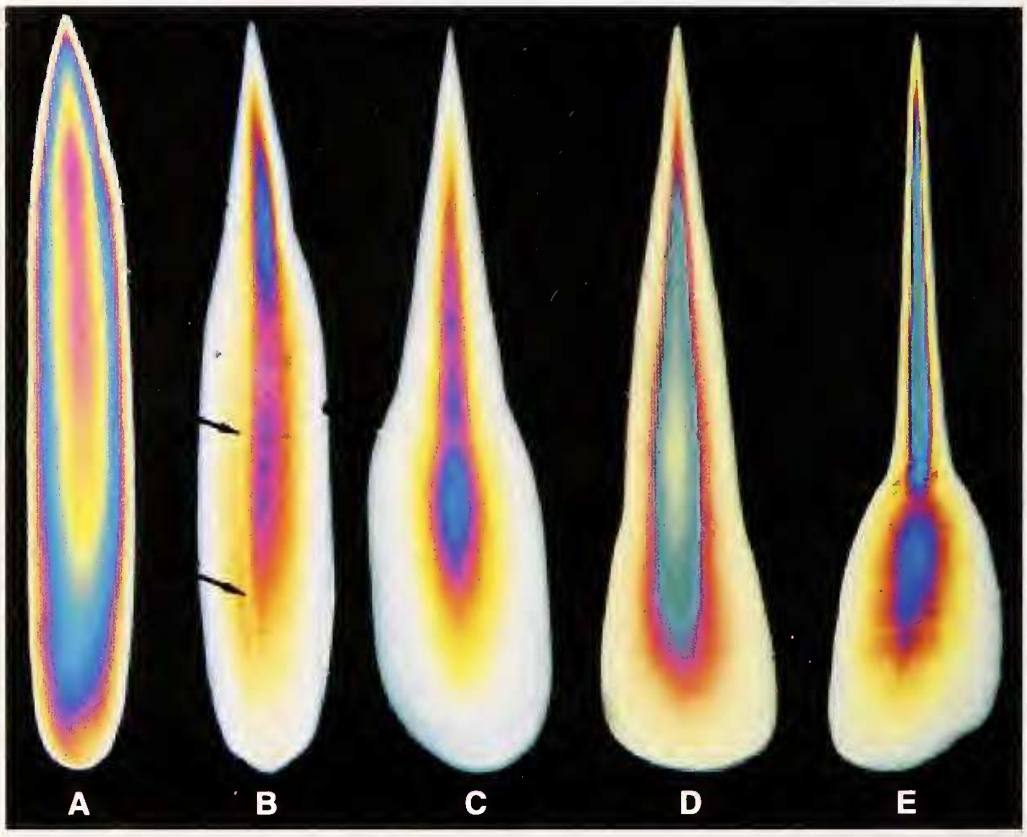

Figure 3. Sclerites of species representing five genera of Prochaetodermatidae photographed under cross-polarized light. All images reproduced at the same length for purposes of comparison; blade and base widths and lengths vary among species within a genus. A. *Claviderma brevicaudatum,* greatest thickness 7.5 μm extending from base to blade. B. *Clevroderma whitlatchi* Scheltema, 1985, greatest thickness 4 μm at waist and blade, and faintly on base; groove (arrows) 2–3 μm; sclerite asymmetrically thickened, 3–3.5 μm (brownish yellow) to left of groove, 3.5 to 4 μm (magenta, blue) to right of groove. C. *Spathoderma clenchi,* greatest thickness 4 μm on base, extending slightly on blade. D. *Prochaetoderma yongei,* greatest thickness 6 μm at waist and on blade. E. *Niteomica hystrix,* greatest thickness 5 μm (green) on blade.

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